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A new fossil oonopid spider in lowermost Eocene amber from the Paris Basin, with comments on the fossil spider assemblage

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ABSTRACT

A new spider species from the family Oonopidae is described from lowermost Eocene amber from Le Quesnoy, Oise department, Paris Basin, France. *Orchestina parisiensis* sp. n. is the first spider to be described from French amber. Preliminary observations on the fossil spider assemblage support a warm climate in this region during the lowermost Eocene. A remarkable feature of this deposit is the absence of jumping spiders (Salticidae) as amber inclusions, because they are frequent in other Tertiary fossil resins. Thus, this new amber deposit may hold vital clues relating to the historical biogeography of the Salticidae, the most diverse spider family on the planet today.

KEY WORDS: Araneae, Haplogynae, Oonopidae, *Orchestina*, French amber, new species.

INTRODUCTION

The family Oonopidae consists of ecribellate, haplogyne spiders less than 3 mm in body length, which have a wide geographical distribution, particularly in the tropics. There are 459 extant species in 67 genera (Platnick 2005). Oonopids are fast-moving, nocturnal hunters that actively pursue their prey and they are often encountered as fossils preserved in amber. Despite being unknown as fossils in sediments, the Oonopidae are known from more fossil deposits than any other spider family and were already widespread by the Cretaceous (Penney 2006). The family also contains the oldest example of an extant spider genus. Their small size, wandering behaviour and widespread distribution may account for their frequent occurrence as amber inclusions, because amber tends to be biased towards trapping wandering, active hunters, rather than sedentary spiders (Penney 2002). For comprehensive reviews of fossil Oonopidae see Wunderlich (1981, 2004) and Penney (2000, 2006).

France has a rich and diverse fossil spider fauna, with both the oldest known mesothele (Selden 1996) and mygalomorph (Selden & Gall 1992) spiders originating from French sediments. Early reports of French fossil spiders include those of Gourret (1888) and Berland (1939) who described araneomorph Tertiary fossil spiders in sediments from Aix en Provence. Spiders in Cretaceous ambers from France have been known for some time (e.g. Schlüter 1978; Néraudeau *et al*. 2002) but these have yet to be described. Recently, Nel *et al*. (2004) identified a new source of undescribed fossil amber spiders from the lowermost Eocene of Le Quesnoy in the Paris Basin and the presence of Oonopidae from this deposit was reported by Penney (2006, text-fig. 2).

The amber-bearing strata occur under the River Oise Quaternary deposits. They prograde toward the north-east and lie at the bottom of two channels, which cut into the underlying Thanetian marine greensands. The Sparnacian beds consist of a succession of lenticular bodies with two main facies. Firstly, clayed sands rich in frequently pyritised lignite, together with amber, and secondly, grey clayey sands with less lignite and with a continental vertebrate fauna (Nel *et al.* 2004). The first reconstruction of the palaeoenvironment was provided by Nel *et al.* (1999) and summarised by Nel *et al.*

(2004). Based upon the fossils identified to date, Nel *et al.* (2004) concluded that some 53 Myr ago the region consisted of a wet river forest surrounded by semi-deciduous or deciduous woodland, in a warm climate with wet and dry seasons.

Inroads have been made with regard to the insect inclusions from the Paris amber (see the various papers in Nel 2004), but spiders have not hitherto been described. A recent research visit to the Muséum National d'Histoire Naturelle in Paris yielded new fossil spiders from this amber deposit. As with most ambers, many of the spiders were juvenile and unidentifiable and most of the adult specimens are still undergoing preparation in Paris. However, one new species was identifiable and this is described herein and preliminary observations on the fossil spider assemblage are provided.

MATERIAL AND METHODS

The specimens upon which this paper is based are deposited in the Muséum National d'Histoire Naturelle (MNHN), Paris, France. All measurements were made using an ocular graticule and photographs were taken with a Nikon D1X digital camera attached to a Wild M8 stereomicroscope.

TAXONOMY

Order Araneae Clerck, 1757
Suborder Opisthothelae Pocock, 1892
Infraorder Araneomorphae Smith, 1902
Family Oonopidae Simon, 1890

Genus *Orchestina* Simon, 1882

Type species: *Schoenobates pavesii* Simon, 1873, by monotypy; Recent, Spain, southern France, Corsica, Algeria.

Remarks: This genus is known from 36 extant species and has a global distribution, primarily in warmer regions (Platnick 2005). Fossils are known in ambers from the Dominican Republic (two species; Wunderlich 1981, 1988), the Baltic region (11 species; Wunderlich 2004), China (one species; Wunderlich 2004), Mexico (one species; Petrunkevitch 1971), Rovno (undescribed; Wunderlich 2004), Canada (one species; Penney 2006), Myanmar (one unnamed specimen; Penney 2006), New Jersey (one unnamed specimen; Penney 2004), Álava (pers. observ.) and copals from Madagascar (one species; Wunderlich 2004), Kenya (two species; Wunderlich 1981) and Colombia (two species; Wunderlich 2004). Extant species are active hunters that jump frequently (Wunderlich 2004), presumably facilitated by their thickened fourth femora.

Orchestina parisiensis sp. n.

Fig. 1

Etymology: After the type locality.

Diagnosis: The main diagnostic characters of male *Orchestina* are the relative proportions of the palpal segments and the shape of the embolus (Wunderlich 2004). The bifid tip of the embolus and the embolus length relative to that of the bulb distinguish the new species.

Description (based primarily on holotype): Body length approximately 1.0 mm; carapace 0.54 mm long, 0.43 mm wide, domed and without the long, erect setae often observed

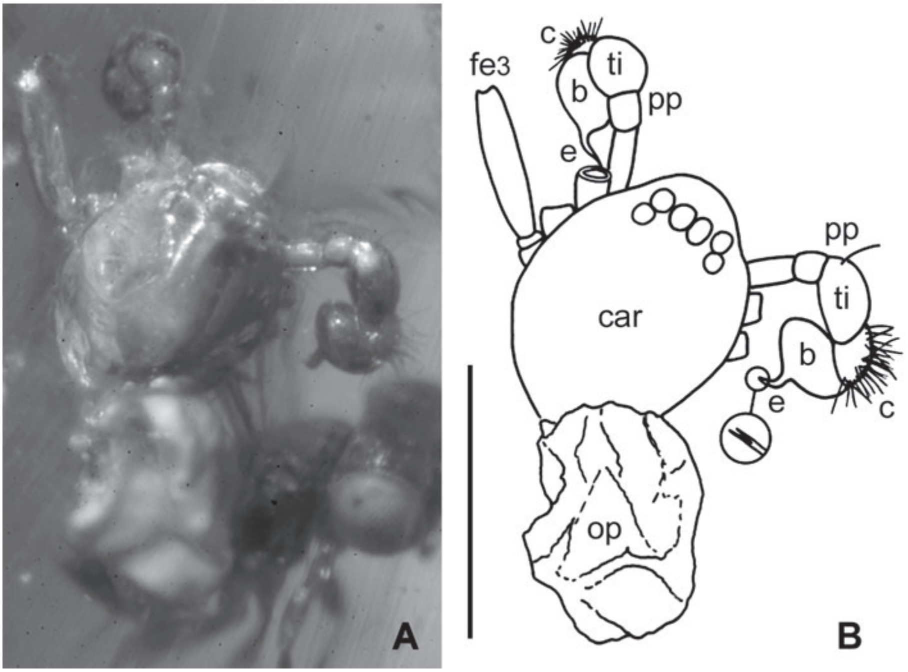

Fig. 1. *Orchestina parisiensis* sp. n., holotype PA 759 (lowermost Eocene amber from Le Quesnoy, Paris Basin, France): (A) dorsal view of the specimen in amber, (B) details of the body structures, dorsal view. Abbreviations: (b) bulb, (c) cymbium, (car) carapace, (e) embolus, (fe) femur, (op) opisthosoma, (pp) pedipalp, (ti) tibia. Scale bar 0.5 mm.

in other fossil *Orchestina*. Six eyes in the segestroid position (*sensu* Wunderlich 2004) typical of the genus. Opisthosoma approximately 0.5 mm long, 0.4 mm wide. Femur of leg 4 (as seen in the paratype) distinctly larger than legs 1–3; all legs without spines. The pedipalp is clearly visible in the holotype: tibia 0.16 mm long, 0.10 mm high, the cymbium is small and highly setose, bulb subspherical, 0.17 mm wide, 0.11 mm high; embolus 0.07 mm long with a kink distally and with a bifid tip (Fig. 1B).

Holotype: PA 759, male, visible in dorsal view, opisthosoma collapsed and covered with a white emulsion as commonly observed in Baltic amber inclusions, spinnerets not visible, only third left leg present and only femur and patella can be seen but are not in a position conducive to taking measurements; there is one cyclorraphan fly syninclusion preserved directly below the holotype. FRANCE: *Oise*: Paris Basin, Le Quesnoy; lowermost Eocene amber.

Paratype: PA 1909, male, same data as the holotype.

Remarks: This is the first spider species to be described from French amber. Based on the palpal structure and particularly the bifid tip of the embolus, the new species is probably most closely related to *O. baltica* Petrunkevitch, 1942 (see Wunderlich 1981, fig. 4, 2004, figs 8k–m). However, the embolus of *O. baltica* is longer than the height of the bulb, whereas that of the new species is shorter. The holotype was selected based on the exceptional view of the pedipalp (the most important structure for species identification in spiders). However, in this specimen the fourth pair of legs is missing, but these are preserved in the paratype and have the thickened femur diagnostic of the genus *Orchestina*.

DISCUSSION

All insect species described from this deposit to date (see Nel *et al.* 2004), and the spider described here, are new to science. Nel *et al.* (2004) considered the fauna to be unique to the Paleocene/Eocene of Western Europe. In addition, from an entomological perspective this fauna appears to have few genera in common with that of the Upper Eocene–Lower Oligocene Baltic amber. The species described above and preliminary observations of additional material suggest that this will not necessarily be the case for the spider fauna, with both deposits sharing numerous genera. However, clarification of this will have to wait until the material in the MNHN has been suitably prepared for systematic study. The spider families provisionally identified to date include: Oonopidae, Theridiidae, Hersiliidae, Segestriidae, Archaeidae, Uloboridae, Pholcidae, Anapidae *s.l.*, ?Tetragnathidae, ?Agelenidae and Selenopidae. This assemblage is characteristic of a warm, sub-tropical environment, supporting the palaeoenvironmental conclusions of Nel *et al.* (1999, 2004).

One remarkable feature of this deposit is the absence of jumping spiders (Salticidae) as amber inclusions. Extant salticids have a global distribution and are the most diverse spider family on the planet today, with more than 5000 recognised species in 550 genera (Platnick 2005). They are highly distinctive as a result of their large anterior median eyes, and can be easily identified even from very tiny juvenile specimens. Thus, they were not accidentally overlooked in the 230+ specimens examined by the author. They occur frequently as Tertiary fossils in ambers from the Baltic region (e.g. Petrunkevitch 1958) and the Dominican Republic (e.g. Penney & Pérez-Gelabert 2002). However, no salticids have been described from Cretaceous deposits. The specimen listed as a salticid in New Jersey amber by Grimaldi *et al.* (2002) and the specimen figured as Salticidae by Néraudeau *et al.* (2002) from Cretaceous amber of France were misidentifications (pers. observ.). It is evident that many extant spider families have a long geological history (Penney *et al.* 2003) and the active, predatory behaviour of salticids predisposes them to becoming trapped in resin (Penney 2002). Therefore, Salticidae may be a recently evolved family and previously their niche may have been occupied by an extinct spider family, such as the Lagonomegopidae (e.g. Eskov & Wunderlich 1995).

The absence of Salticidae in this deposit is a sufficient cause to question the Tertiary age of this amber. However, the absence of the strictly fossil family Lagonomegopidae, which is relatively common in Cretaceous ambers (e.g. Penney 2005) supports a Tertiary age for this deposit. The absence of Salticidae is certainly enigmatic and this new amber deposit may hold vital clues relating to the historical biogeography of the most diverse spider family on the planet today.

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